



[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. FAA-2012-1301; Special Conditions No. 25-491-SC]

Special Conditions: Embraer S.A., Model EMB-550 Airplane, Dive Speed Definition with Speed Protection System.

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions.

SUMMARY: These special conditions are issued for the Embraer S.A. Model EMB-550 airplane. This airplane will have a novel or unusual design feature when compared to the state of technology envisioned in the airworthiness standards for transport category airplanes. These design features include a high-speed protection system. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

EFFECTIVE DATE: [Insert date 30 days after date of publication in the *Federal Register*].

FOR FURTHER INFORMATION CONTACT: Todd Martin, FAA, Airframe and Cabin Safety Branch, ANM-115, Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue SW., Renton, Washington, 98057-3356; telephone 425-227-1178; facsimile 425-227-1149.

SUPPLEMENTARY INFORMATION:

Background

On May 14, 2009, Embraer S.A. applied for a type certificate for their new Model EMB-550 airplane. The Model EMB-550 airplane is the first of a new family of jet airplanes designed for corporate flight, fractional, charter, and private owner operations. The aircraft has a conventional configuration with low wing and T-tail empennage. The primary structure is metal with composite empennage and control surfaces. The Model EMB-550 airplane is designed for 8 passengers, with a maximum of 12 passengers. It is equipped with two Honeywell HTF7500-E medium bypass ratio turbofan engines mounted on aft fuselage pylons. Each engine produces approximately 6,540 pounds of thrust for normal takeoff. The primary flight controls consist of hydraulically powered fly-by-wire elevators, ailerons and rudder, controlled by the pilot or copilot sidestick.

The Model EMB-550 airplane incorporates a high-speed protection system in the airplane's flight control laws. The airplane's high-speed protection system limits nose-down pilot authority by adding automatic control inputs at threshold speeds above V_{MO}/M_{MO} , which influence the results of the traditional recovery maneuvers required in Title 14, Code of Federal Regulations (14 CFR) 25.335(b)(1). This speed protection system was not envisioned when § 25.335 was promulgated.

Type Certification Basis

Under the provisions of 14 CFR 21.17, Embraer S.A. must show that the Model EMB-550 airplane meets the applicable provisions of part 25, as amended by Amendments 25-1 through 25-127 thereto.

If the Administrator finds that the applicable airworthiness regulations (i.e., 14 CFR part 25) do not contain adequate or appropriate safety standards for the Model EMB-550 airplane because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

Special conditions are initially applicable to the model for which they are issued. Should the type certificate for that model be amended later to include any other model that incorporates the same or similar novel or unusual design feature, the special conditions would also apply to the other model under § 21.101.

In addition to the applicable airworthiness regulations and special conditions, the Model EMB-550 airplane must comply with the fuel vent and exhaust emission requirements of 14 CFR part 34 and the noise certification requirements of 14 CFR part 36 and the FAA must issue a finding of regulatory adequacy under § 611 of Public Law 92-574, the “Noise Control Act of 1972.”

The FAA issues special conditions, as defined in 14 CFR 11.19, in accordance with § 11.38, and they become part of the type-certification basis under § 21.17(a)(2).

Novel or Unusual Design Features

The Model EMB-550 airplane will incorporate the following novel or unusual design features: a high-speed protection system that limits nose-down pilot authority at speeds above V_{MO}/M_{MO} . This system prevents the airplane from performing the maneuver required under § 25.335(b)(1).

Discussion

Section 25.335(b)(1) is a dive speed condition that was originally adopted in part 4b of the Civil Air Regulations in order to provide an acceptable speed margin between design cruise speed and design dive speed. Flutter clearance design speeds and airframe design loads are impacted by the design dive speed. While the initial condition for the upset specified in the rule is 1g level flight, protection is afforded for other inadvertent overspeed conditions as well. Section 25.335(b)(1) is intended as a conservative enveloping condition for potential overspeed conditions, including non-symmetric conditions. To ensure that potential overspeed conditions are covered, the applicant should demonstrate that the dive speed will not be exceeded in inadvertent, or gust-induced, upsets resulting in initiation of the dive from non-symmetric attitudes; or that the airplane is protected by the flight control laws from getting into non-symmetric upset conditions. The applicant should conduct a demonstration that includes a comprehensive set of conditions, as described in the special conditions.

These special conditions are in lieu of § 25.335(b)(1). Section 25.335(b)(2), which also addresses the design dive speed, is applied separately. Advisory Circular (AC) 25.335-1A, *Design Dive Speed*, dated September 29, 2000, provides an acceptable means of compliance to § 25.335(b)(2)).

Special conditions are necessary to address the high-speed protection system on the Model EMB-550. The special conditions identify various symmetric and non-symmetric maneuvers that will ensure that an appropriate design dive speed, V_D/M_D , is established.

These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

This special condition is in lieu of 14 CFR 25.335(b)(1). Section 25.335(b)(2), also addresses the design dive speed, but it is applied separately. Advisory Circular (AC) 25.335-1A, *Design Dive Speed*, dated September 29, 2000, provides an acceptable means of compliance to § 25.335(b)(2).

Discussion of Comments

Notice of proposed special conditions number 25-12-18-SC for the Embraer S.A. Model EMB-550 airplanes was published in the *Federal Register* on January 24, 2013 (78 FR 5146). We received no substantive comments, and the special conditions are adopted as proposed.

Applicability

As discussed above, these special conditions are applicable to the Model EMB-550 airplane. Should Embraer S.A. apply at a later date for a change to the type certificate to include another model incorporating the same novel or unusual design feature, the special conditions would apply to that model as well.

Conclusion

This action affects only certain novel or unusual design features on one model of airplanes. It is not a rule of general applicability.

List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701, 44702, 44704.

The Special Conditions

Accordingly, pursuant to the authority delegated to me by the Administrator, the following special conditions are issued as part of the type certification basis for Embraer S.A. Model EMB-550 airplanes.

1. Dive Speed Definition with Speed Protection System.

(1) In lieu of the requirements of 14 CFR 25.335(b)(1), if the flight control system includes functions that act automatically to initiate recovery before the end of the 20-second period specified in § 25.335(b)(1), V_D/M_D must be determined from the greater of the speeds resulting from the conditions (a) and (b) below. The speed increase occurring in these maneuvers may be calculated if reliable or conservative aerodynamic data are used.

(a) From an initial condition of stabilized flight at V_C/M_C , the airplane is upset and takes a new flight path 7.5 degrees below the initial path. Control application, up to full authority, is made to try and maintain this new flight path. Twenty seconds after initiating the upset, manual recovery is made at a load factor of 1.5g (0.5 acceleration increment), or such greater load factor that is automatically applied by the system with the pilot's pitch control neutral. Power, as specified in § 25.175(b)(1)(iv), is assumed until recovery is initiated, at which time power reduction and pilot-controlled drag devices may be used.

(b) From a speed below V_C/M_C , with power to maintain stabilized level flight at this speed, the airplane is upset so as to accelerate through V_C/M_C at a flight path 15 degrees below the initial path (or at the steepest nose down attitude that the system will permit with full control authority if less than 15 degrees). The pilot's controls may be in the neutral position after

reaching V_C/M_C and before recovery is initiated. Recovery may be initiated three seconds after operation of the high-speed warning system by application of a load of 1.5g (0.5 acceleration increment), or such greater load factor that is automatically applied by the system with the pilot's pitch control neutral. Power may be reduced simultaneously. All other means of decelerating the airplane, the use of which is authorized up to the highest speed reached in the maneuver, may be used. The interval between successive pilot actions must not be less than one second.

(2) The applicant must also demonstrate that the speed margin, established as above, will not be exceeded in inadvertent, or gust-induced, upsets resulting in initiation of the dive from non-symmetric attitudes, unless the airplane is protected by the flight control laws from getting into non-symmetric upset conditions. The upset maneuvers described in paragraphs 32.c(3)(a) and 32.c(3)(c) of AC 25-7C, *Flight Test Guide for Certification of Transport Category Airplanes*, dated October 16, 2012, may be used to comply with this requirement.

(3) Any failure of the high-speed protection system that would result in an airspeed exceeding those determined by paragraphs (1) and (2) must be less than 10^{-5} per flight hour.

(4) Failures of the system must be annunciated to the pilots. Flight manual instructions must be provided that reduce the maximum operating speeds V_{MO}/M_{MO} . The operating speed must be reduced to a value that maintains a speed margin between V_{MO}/M_{MO} and V_D/M_D that is consistent with showing compliance with § 25.335(b) without the benefit of the high-speed protection system.

(5) Dispatch of the airplane with the high-speed protection system inoperative could be allowed under an approved minimum equipment list (MEL) that would require flight manual instructions to indicate reduced maximum operating speeds, as described in paragraph (4). In

addition, the flightdeck display of the reduced operating speeds, as well as the overspeed warning for exceeding those speeds, must be equivalent to that of the normal airplane with the high-speed protection system operative. Also, it must be shown that no additional hazards are introduced with the high-speed protection system inoperative.

Issued in Renton, Washington, on May 21, 2013.

Jeff Duven
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Aircraft Certification Service

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